Remarks

Applicants respectfully request reconsideration of the present U.S. Patent application. Claims 1, 12, 18 and 20 have been amended. No claims have been added or canceled. Thus, claims 1-37 are pending.

The above amendments are made consistent with an interview with the Examiner on October 3, 2006. Applicants understand that the Examiner is preparing a summary of that interview. Therefore, Applicants are not submitting a summary at this time.

Amendment to the Specification

The current Application claims priority to provisional application 60/080,501 (filed April 2, 1998) and to the non-provisional application 09/209,828 (filed December 11, 1998). Applicants submit an amendment to the Specification to show other applications/patents that also claim priority to either of the above applications:

U.S Pat. No. 6408029, Issued 6/18/2002, Applic. No. 09/274153, Filed 3/22/1999

U.S. Pat. No. 6574278, Issued 6/3/2003, Applic. No. 09/274151, Filed 3/22/1999

U.S. Pat No. 7046734, Issued 5/16/2006, Applic. No. 10/339016, Filed 1/8/2003

Applic. No. 11/129558, Filed 12/1/2005

Applic. No. 09/274,157, Filed 3/22/1999 (Discussed below).

This information is submitted merely for purposes of disclosure and Applicants make no representation regarding the above cases. An Information Disclosure Statement (IDS) with references is submitted with this Response.

Applicants respectfully note that an IDS that was filed on October 28, 2004 has not yet been considered by the Office. This is according to the USPTO's Patent Application Information Retrieval (PAIR) system.

Provisional Double Patenting Rejection

The July 7, 2006 Office Action ("Office Action") rejects claims 1, 12, 18, and 20 on the ground of nonstatutory double patenting over claims 1, 8 and 16 of copending Application No. 09/274,157. The rejection is provisional only because the allegedly conflicting claims have not yet been patented.

Applicants submit along with this Response an executed Terminal Disclaimer to Obviate a Provisional Double Patenting Rejection over a Pending Second Application. Both applications have been commonly assigned to and are owned by Intel Corporation of Santa Clara, CA. Applicants respectfully request that the provisional nonstatutory double-patenting rejection of claims 1, 12, 18, and 20 be withdrawn.

Claim Rejections - 35 U.S.C. § 103(a)

Igarashi and Ju

Claims 1-37 were rejected as being unpatentable over U.S. Patent No. 5,539,466 issued to Igarashi, et al. (*Igarashi*) in view of U.S. Patent No. 5,801,778 issued to Ju (*Ju*).

For at least the reasons set forth below, Applicants submit that claims 1-37 are not rendered obvious by *Igarashi* and *Ju*.

Preliminarily, independent claims 1, 12, 18 and 20 have been amended to recite: 1) Performing only unidirectional forward prediction if a temporally closest anchor frame precedes a predicted frame; and 2) Performing only unidirectional backward prediction if a temporally closest anchor frame is subsequent to a predicted frame. (See: Specification, p. 18, line 11 – p. 19, line 19).

Claim 1 now recites:

> 1. A method for performing motion estimation comprising:
>
> receiving a stream of data comprising at least a predicted frame and a temporally closest anchor frame;
>
> **if the temporally closest anchor frame is previous to the predicted frame,** utilizing even-parity field prediction **to only unidirectionally forward predict** content of each of a plurality of fields of the unidirectionally forward predicted frame from corresponding fields of **only the temporally closest anchor frame**; and
>
> **if the temporally closest anchor frame is subsequent to the predicted frame,** utilizing even-parity field prediction to **only unidirectionally backward predict** content of each of a plurality of fields of the unidirectionally backward predicted frame from corresponding fields of **only the temporally closest anchor frame**;
>
> wherein the unidirectionally predicted frame **that is predicted only from the temporally closest anchor frame** comprises a frame that is defined as a bi-directionally predicted frame according to an encoding protocol for the stream of data.
>
> (Emphasis added).

Amended claim 1 recites performing only unidirectional forward prediction if the temporally closest anchor frame precedes the predicted frame and performing only unidirectional backward prediction if the temporally closest anchor frame is subsequent to the predicted frame. It is the entire predicted frame, not just individual fields, that is only unidirectionally predicted as recited above. Thus, claim 1 recites frame-based unidirectional prediction. *Igarashi* and *Ju* do not teach or suggest at least the above limitations of claim 1.

In responding to our previous argument, the Office reviewed the current application and states that, "There is no disclosure of '**only** the temporally closest anchor frame' for unidirectional prediction. Therefore, the following rejections are best understand." (Office Action, p. 4).

There are at least two responses to the above statement by the Office. First, the current application does disclose use of "only the temporally closest anchor frame" for frame-based, unidirectional prediction. Second, when the claims are not ambiguous, the Office may not resort to the specification to change the clear meaning of the claims.

Regarding the first response, the current application contains the following disclosure:

> Turning briefly to **Figure 9** an innovative method for performing temporally constrained, **unidirectional B-frame motion** estimation **900** is presented. In accordance with the illustrated example embodiment, the method begins upon receipt of a B-frame which is to be inter-frame encoded, step **902**. In step **904**, **a single anchor frame is selected** from which the content of the B-frame is to be predicted. In accordance with one embodiment of the present invention, **the temporally closest anchor frame, whether preceding or**

superseding the B-frame is selected. In step **906**, in contradiction to the well established method for predicting B-frame content, **the content of the B-frame is unidirectionally interpolated from the content of the above identified temporally closest anchor frame**, in accordance with one aspect of the present invention. More specifically, in accordance with one embodiment of the present invention, **the content of the B-frame is unidirectionally interpolated using the content of the temporally closest anchor frame** and a motion vector calculated based on the temporally closest anchor frame. In one embodiment, the motion vector is the sum of absolute differences (SAD) of the activity within the anchor frame, e.g., within each scan line of the anchor frame.

Graphically, the temporally constrained, unidirectional interpolation of a B-frame is presented with reference to **Figure 10**. As shown in Figure 10, **rather than bidirectionally interpolating the content of B-frame 1004 from past and future anchor frames, the content of B-frame 1004 is unidirectionally interpolated by the closest anchor frame,** i.e., I-frame **1002**, in accordance with one aspect of the present invention. **Similarly, B-frame 1006 is unidirectionally interpolated from the temporally closest anchor frame**, P-frame **1008**, in accordance with this aspect of the present invention. As shown, inter-frame encoding of P-frame **1008** is premised on the nearest past anchor frame, in this example, I-frame **1002**.

Although contrary to the well established practice for predicting B-frame content, the innovative temporally constrained, unidirectional B-frame technique of **Figure 9** has been empirically shown to provide substantially the same quality decoded picture as video encoded using the standard B-frame encoding process, while using only a fraction of the normal computational requirements. Accordingly, those skilled in the art will appreciate, based on the foregoing, that this aspect of the present invention, namely, **the temporally constrained unidirectional interpolation of B-frames** greatly reduces the computation complexity of inter-frame compression, thereby facilitating greater encoding throughput with minimal degredation to the quality of the encoded data.

(Application, Paragraphs 58-60, pp. 18-19) (Emphasis, except emphasis of figure and reference numbers, is added).

Thus, the disclosure unambiguously describes performing only unidirectional frame prediction using only the temporally closest anchor frame. Although "only" is not explicitly used, the meaning could not be clearer: "[T]he **temporally closest anchor frame, whether preceding or superseding the B-frame is selected."** (*Id.*, ¶ 58, p. 18) (bold added). This prediction of B-frames is contrasted with the conventional wisdom of performing bi-directional prediction of B-frames.

The Office cannot insist that the exact word "only" be used. Claims do not have to use the exact same language as the specification. *See*: MPEP § 2163.02 ("The subject matter of a claim need not be described literally," for example, "using the same terms or *in haec verba* . . . ."). Here, the specification unambiguously states that frame-based, unidirectional prediction of B-frames is to be performed using only the temporally closest anchor frame.

Secondly, the Office cannot use the specification to read the claims in a way that is contrary to their plain meaning. Here, there is no question about what claim 1 states. Claim 1 unambiguously recites performing only frame-based, unidirectional prediction of B-frames using only the temporally closest anchor frame. "[T]he words in a claim are generally not limited in their meaning by what is shown or disclosed in the specification." MPEP § 2111.01.

Turning to the references, the Office concedes that *Igarashi* does not teach unidirectional prediction of a frame defined as bi-directionally predicted. (Office Action,

p. 6). The Office relies on col. 2, lines 17-50 of *Ju*, as describing unidirectional prediction of B-frames. (Office Action, p. 7). This cited portion of *Ju* merely restates the conventional view that B-frames may be bi-directionally predicted or unidirectionally predicted. However, neither the cited passage nor the rest of *Ju* col. 2 discusses performing only unidirectional prediction of B-frames using only the temporally closest anchor frame. Certainly nothing describes performing only unidirectional forward prediction if the temporally closest anchor frame precedes the predicted frame and performing only unidirectional backward prediction if the temporally closest anchor frame is subsequent to the predicted frame.

The Office recognizes that *Ju* describes unidirectional and bi-directional prediction of B frames, summarizing it as follows:

> Wherein B frame macroblock may be predicted from a macroblock of an I frame or a P frame, but no predictions are made from B frame macroblocks, which means Ju would obviously predict B frame using either (b) unidirectional forward predictive coded or (c) unidirectional backward predictive coded using temporal encoding relative to a subsequent reference frame to predict a B frames in a field prediction mode . . . .
>
> Therefore, taking the teachings of Igarashi and Ju as a whole, it would have been obvious to one of ordinary skill in the art to incorporate the teachings of Ju into the apparatus of Igarashi to predict the B frame **using the unidirectional of the closest anchor frame.**
>
> (Office Action, p. 7) (Emphasis added).

Despite the Office's emphasized statement regarding, "using the unidirectional of the closest anchor frame," that is not what *Ju* does. *Ju* does not teach or suggest doing what the Office describes in the emphasized text.

When *Ju* does forward prediction, it uses the closest previous frame. When *Ju* does unidirectional backward prediction, it uses the closest subsequent frame. But what *Ju* does not do is use the closest reference frame, and only the closest reference frame, and letting that determine whether the unidirectional prediction is forward or backward.

Applicants' view of *Ju* has been confirmed by the Board of Patent Appeals and Interferences[1] when it held as follows:

> Although we agree with the examiner that Ju teaches a frame-based encoding technique, **we do not agree with the examiner that Ju discloses an encoding technique in which the content of each B-frame is unidirectionally predicted from a temporally closest anchor frame**. Ju teaches that encoding of a B-frame can be intracoded, unidirectional forward predictive coded, unidirectional backward predictive coded using temporal encoding relative to a subsequent reference frame or bidirectional predictive coded using temporal coding relative to both previous and subsequent reference frames. None of these options can ensure that the predictive coding is based on the temporally closest anchor frame. In other words, the unidirectional codings of Ju, which use a previous anchor frame or a subsequent anchor frame do not take into account which of the previous or subsequent anchor frames is the temporally closest frame to the B-frame in question. **There is no indication in Ju that the particular unidirectional coding technique used is based on which anchor frame is the temporally closest anchor frame to the B-frame being processed.**

Thus, in the Board's view, *Ju* determines whether to forward or backward predict first. It does not first find the closest anchor frame and then based on which anchor frame is the closest, decide whether to forward or backward predict. The Board recognized this fact

[1] Ex parte Jeffrey S. McVeigh and Michael Keith, Appeal No. 2003-0812 and Application No. 09/274,147 (August 20, 2004), pp. 5-6.

about *Ju* and held that *Ju* does not disclose unidirectional prediction using only the temporally closest anchor frame. It is respectfully submitted that the Office should follow the Board's decision in this regard.

Thus, *Igarashi* in view of *Ju* neither teaches nor suggests at least the above limitations of claim 1. The final Office Action therefore fails to present a *prima facie* case of obviousness. MPEP § 2141.03 (All limitations must be taught or suggested).

All of the remaining independent claims 12, 18, 20, 30, and 31 have very similar or identical limitations regarding performing only unidirectional prediction, using only the temporally closest anchor frame, of a frame that is defined as a bi-directionally predicted frame by an encoding protocol. Therefore, they are also patentable over *Igarashi* in view of *Ju* for the reasons discussed above.

Dependent claims 2-11, 13-17, 19, 21-29, 32-37 incorporate all the limitations of at least one of the above patentable independent claims. This includes the limitation regarding performing only unidirectional prediction, using only the temporally closest anchor frame, of a frame that is defined as a bi-directionally predicted frame by an encoding protocol. Because *Igarashi* in view of *Ju* fails to teach or suggest at least this limitation, these claims are also patentable over those references. MPEP § 2141.03 (Dependent claims are patentable over a reference when the reference does not teach or suggest all limitations of the independent claim).

Igarashi and Ngai

Claims 1-37 were also rejected as being unpatentable over U.S. Patent No. 5,539,466 issued to Igarashi, et al. (*Igarashi*) in view of U.S. Patent No. 5,650,832 issued

to Ngai et al. (*Ngai*). For at least the reasons set forth below, Applicants submit that claims 1-37 are not rendered obvious by *Igarashi* and *Ngai*.

The combination of *Igarashi* and *Ngai* also fail to teach or suggest the limitation of claim 1 that 1) a predicted frame is only unidirectionally forward predicted if the temporally closest anchor frame is prior to the predicted frame and 2) a predicted frame is only unidirectionally backward predicted if the temporally closest anchor frame is subsequent to the predicted frame. That is, under claim 1, the location of the temporally closest anchor frame determines whether the unidirectional predicting is forward or backward. Just the opposite is described in *Ngai*.

This discussion focuses on Ngai because once again the Office concedes that *Igarashi* does not teach unidirectional prediction of a frame defined as bi-directionally predicted. (Office Action, p. 10). The Office relies on col. 2, lines 46-52 of Ngai. (Office Action, p. 10). This cited portion of *Ngai* states in relevant part:

> [A] "B" Bidirectional Picture can be coded by **forward prediction** from the **closest past** "I" or "P" Picture, by **backward prediction** from the **closest future** "I" or "P" Picture, or bidirectionally . . . .
>
> Ngai, col. 2, lines 46-49 (Emphasis added).

As in *Ju* ,*Ngai* first decides whether it is performing forward prediction or backward prediction. Then it selects the anchor frame that is the closest in the direction in which it has already decided to predict. If it is doing forward prediction, it uses the "closest past" anchor picture even if the closest anchor picture is a future picture. If it is doing

backward prediction, it uses the "closest future" anchor picture even if the closest anchor picture is a past picture. Thus, exactly as the Board said regarding *Ju*, what is disclosed in *Ngai* cannot guarantee that the only temporally closest anchor frame will be used for the B-frame being processed.

The prediction technique described in *Ngai* is the exact opposite of what claim 1 recites. Under claim 1, the location of the temporally closest anchor frame is what decides whether the prediction is unidirectionally forward or unidirectionally backward. If the temporally closest anchor frame precedes the predicted frame, then only unidirectional forward prediction is done. If the temporally closest anchor frame succeeds the predicted frame, the only unidirectional backward prediction is done. The location of the temporally closest anchor frame determines whether unidirectional forward or backward prediction is performed.

Ngai also fails to teach or suggest frame-based prediction. *Ngai* states, "Per the MPEG standard, **motion estimation is performed on the macroblock**. The video image is divided into units of 16 x 16 pixels called a macroblock." (Ngai, col. 5, lines 7-9) (Emphasis added). *Ngai* also states, "**each 16 x 16 pixel block** of a 'B' Bidirectional picture can be coded by forward prediction from the closest past 'I' or 'P' Picture . . . ." (*Ngai*, col. 2, lines 45-48) (Emphasis added). In contrast, as discussed above, claim 1 recites frame-based prediction.

Therefore, *Ngai* also fails to teach or suggest at least the above limitations of claim 1. Therefore, claim 1 is not rendered obvious by the combination of *Igarashi* and *Ngai*. As discussed above, all the remaining independent claims 12, 18, 20, 30, and 31

have very similar or identical limitations regarding performing only unidirectional prediction, using only the temporally closest anchor frame, of a frame that is defined as a bi-directionally predicted frame by an encoding protocol. Therefore, they are also not rendered obvious by the combination of *Igarashi* and *Ngai* for the reasons discussed above.

Dependent claims 2-11, 13-17, 19, 21-29, 32-37 incorporate all the limitations of at least one of the above patentable independent claims. Therefore, they are also not rendered obvious by the combination of *Igarashi* and *Ngai*. MPEP § 2141.03.

CONCLUSION

For at least the foregoing reasons, Applicants submit that the rejections have been overcome. Therefore, claims 1-37 are in condition for allowance and such action is earnestly solicited. The Office is respectfully requested to contact the undersigned by telephone if such contact would further the examination of the present application. Please charge any shortages and credit any overcharges to our Deposit Account number 02-2666.

Respectfully submitted,
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